

What is EPIC Bioscience? Goals & Context

Digitized museum collections are an enormous source of untapped potential to engage young learners in science investigations using specimens to address pressing global questions.

EPIC Bioscience creates interactive, online science investigations aligned to NGSS for middle school learners. Following in the footsteps of the [Research Quest](#) suite of investigations, students gather information directly from museum specimens and analyze their data to develop evidence-based arguments related to global issues of biodiversity loss and climate change.



Young learners of middle school age engaging in an EPIC Bioscience investigation.

Investigating Artifacts

6th-8th Graders
Dive into current archaeological research to understand the activities and innovations of people living 1,000+ years ago.

Change in the Uinta Mountains

6th-8th Graders
Launch your own investigation into the changes taking place in the Uinta Mountains. Are those changes normal or not?

Cleveland-Lloyd Dinosaur Quarry

6th-8th Graders
Engage in real-world research from Utah's world-renowned Cleveland-Lloyd Dinosaur Quarry.

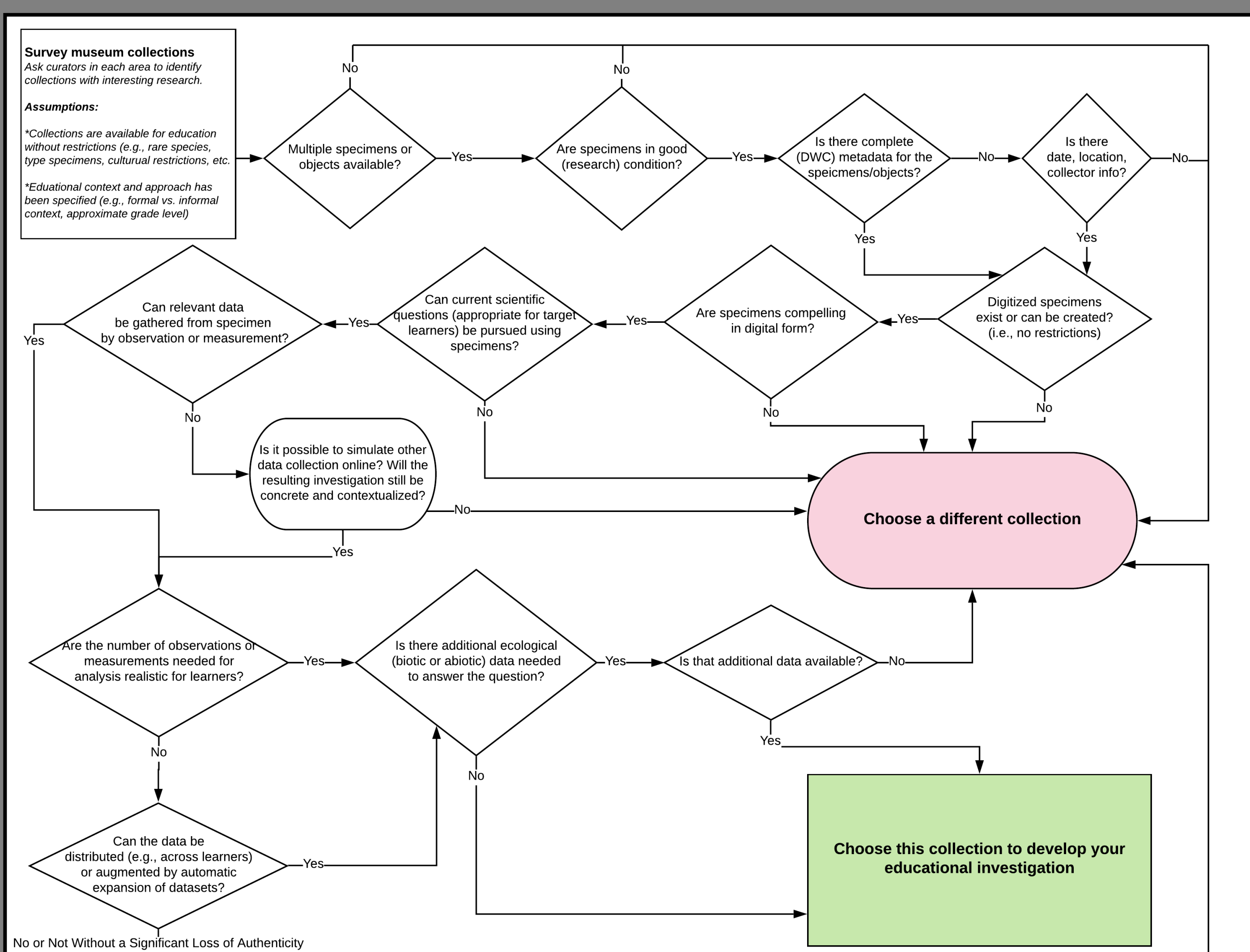
To Eat or Not To Eat?

6th-8th Graders
Wonder how predators choose their prey? Conduct your own research to find out.

Preview of available online science investigations. Visit: <https://researchquest.org/>.



Developing Educational Investigations with Digitized Specimens



Collection selection process workflow.

Museum collections vary in their temporal and spatial extent and resolution as well as in their metadata quality. Because of the nuances of museum collections, selecting objects that will adequately convey desired scientific exploration goals is crucial. Collectors and curators use various preparation and preservation approaches, often driven by research-specific objectives or curatorial tradition. Using a workflow to help narrow down suitable collections for educational purposes has proven useful

Educational Investigation 1: Vertebrate Zoology & Entomology

Investigation: InsectApocalypse!

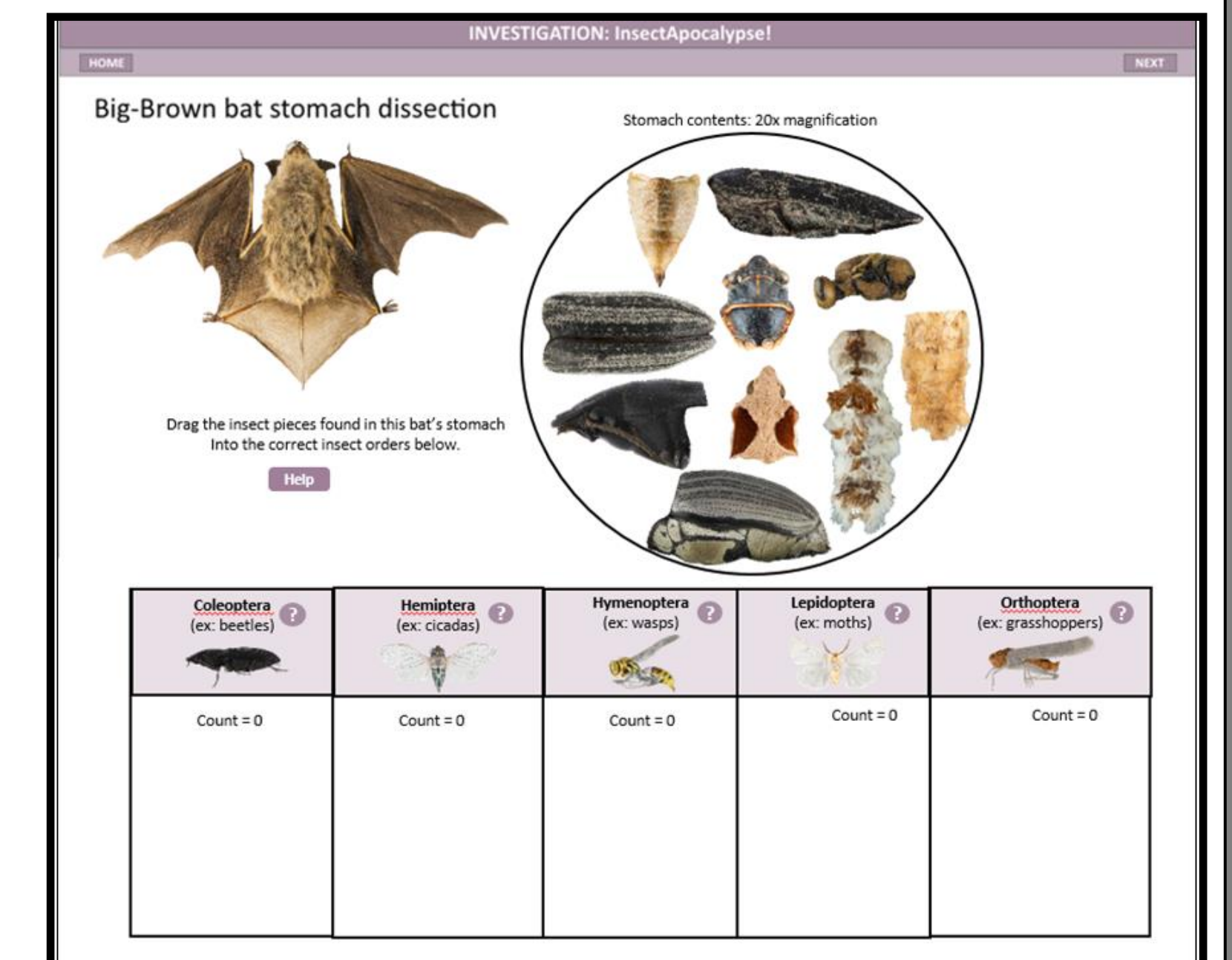
NGSS standard1: "Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem."

Phenomenon: Effects of insect decline on other species within a particular environment.

Focus: Bats and their diets.

Guiding Question: As insect populations undergo an unprecedented, rapid decline, how will bat species be affected by sudden changes in their dietary resources? Can they adjust?

Bats were selected for this investigation because they are intriguing organisms (the only flying mammal!) for students to engage with. The number (~1300) and quality of specimens at NHMU provided ample opportunity to create a robust investigation.



Example storyboard page demonstrating how the stomach content analysis work.

Educational Investigation 2: Entomology

Investigation: To Eat or Not to Eat

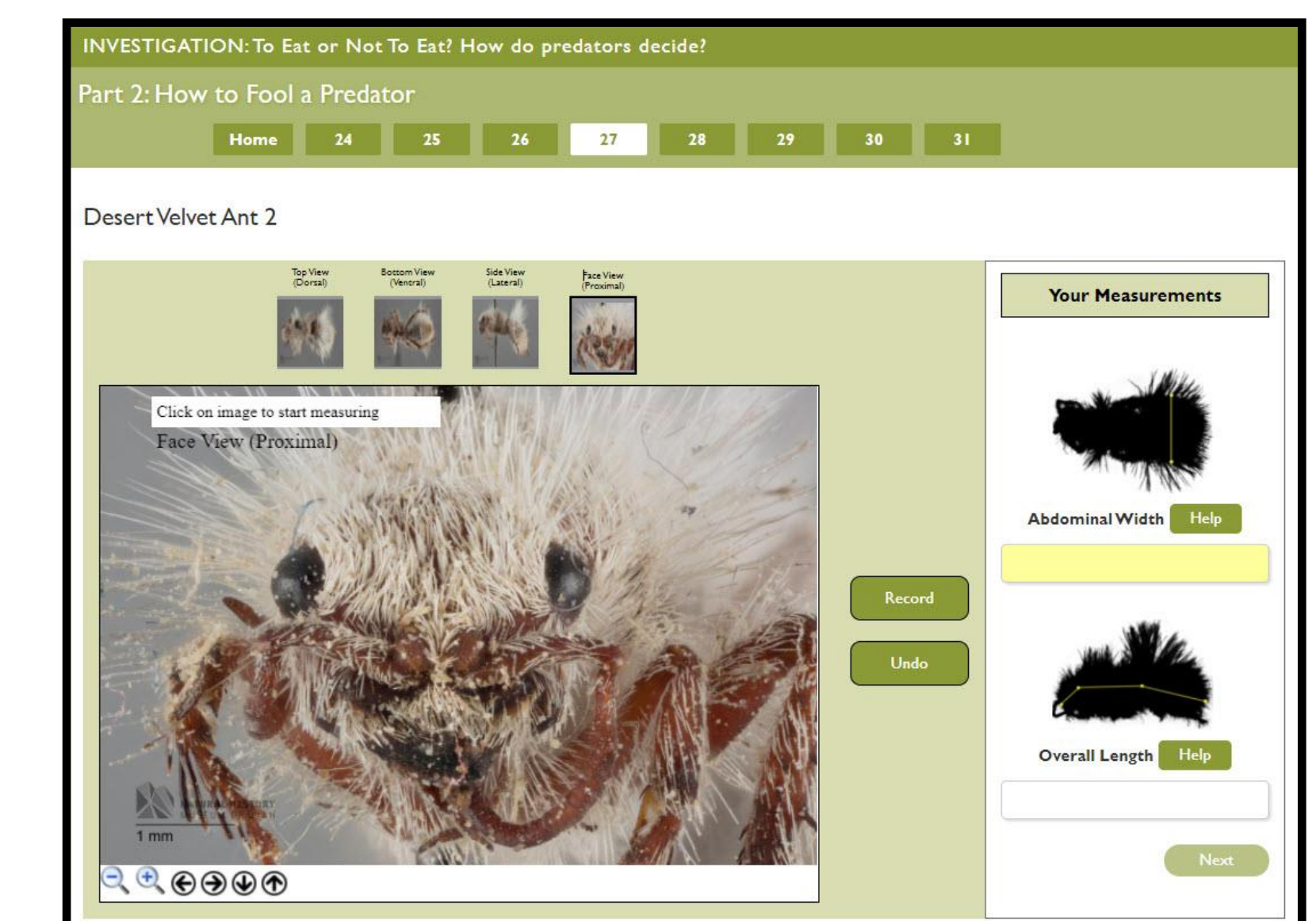
NGSS standard2: "Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems."

Phenomenon: Effects of mimicry (species imitating other species) on predator behaviors.

Focus: Velvet ants and their mimicry rings.

Guiding Question: What physical features drive predator behaviors when encountering harmful prey and their mimics?

Velvet ants were chosen because they are very unique organisms, with 5 strong defenses preventing predation (including the most painful sting in the world!). NHMU has a large number of available specimens (~400) from several mimicry rings across western North American environments.



Beta version web page showing velvet ant specimen and the interactive measurement tool.

Educational Investigation 3: Sedimentary archives

Investigation: Secret Agents in the Soil

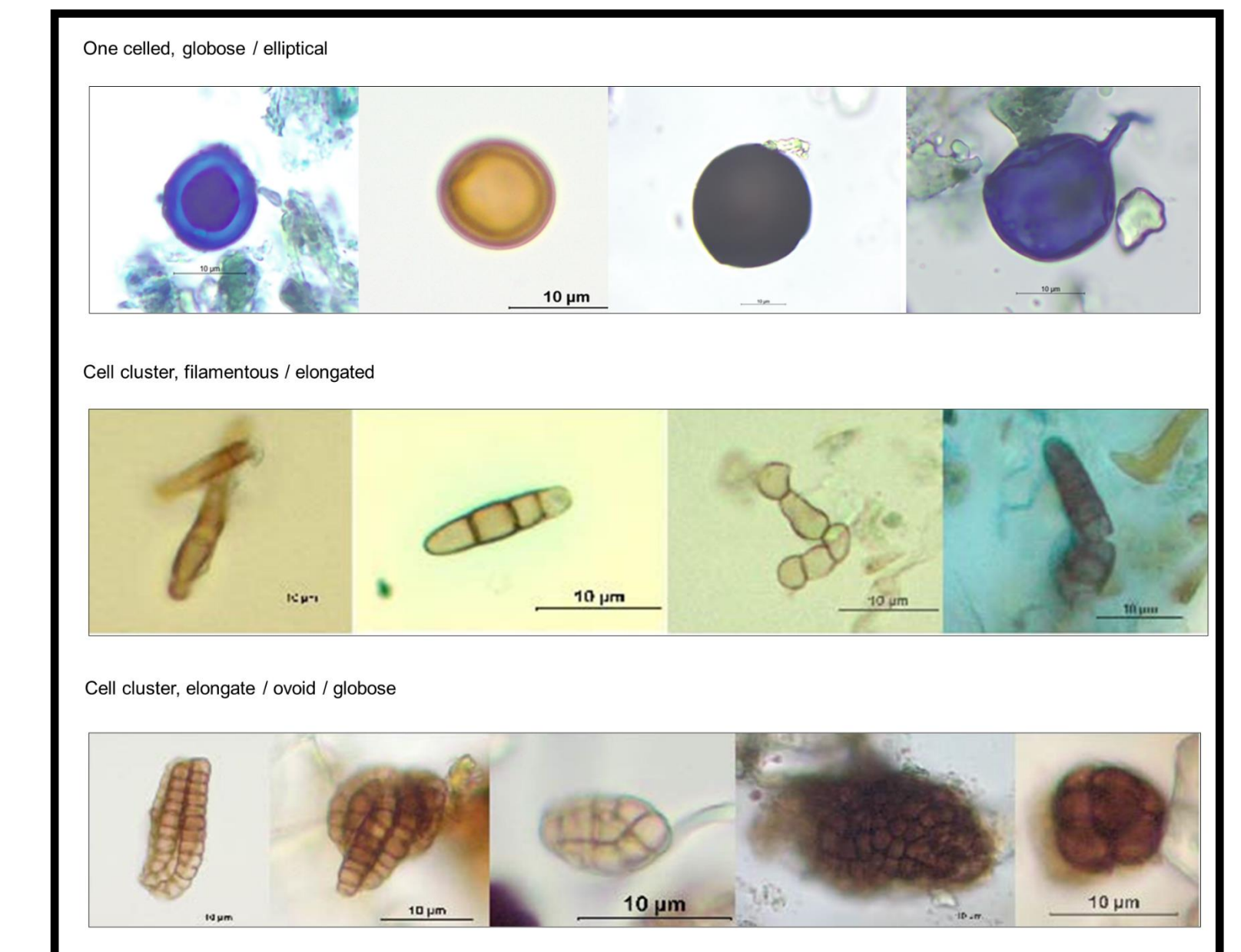
NGSS standard3: "Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem."

Phenomenon: Rates of decomposition of organic matter across environmental gradients.

Focus: Fungal spores and other fungal remains.

Guiding Question: Why do different materials decompose at varying rates across environments?

Fungi is an unexplored kingdom (~1% known to science!) compared to others that dominate middle school curriculum. Fungi provide a unique entry point into exploring matter and energy cycling.



Proposed morphology categories of fungal spore remains.

Conclusion: Using museum collections as a resource to educate middle school students provides them with the opportunity to use research-driven approaches, including gathering data, analyzing results, and forming conclusions on global phenomena. There is unlimited potential for museum-education crossover to benefit museum stakeholders, community learners and laboratory researchers.

Recent Work: Butcher, K. R., Power, M. J., Larson, M., Orr, M. P., Velásquez-Franco, S., Hudson, M. A., & Bailey, V. J. (2021). Museum Leadership for Engaging, Equitable Education: The Transformative Potential of Digitized Collections for Authentic Learning Experiences. *Curator*, 64(2), 383–402. <https://doi.org/10.1111/cura.12423>